

WHAT IS CLAIMED:

1. An implantable system comprising:
 - (a) a cell repopulation source capable of forming new contractile tissue in and/or near damaged or diseased myocardial tissue; and
 - (b) an electrical stimulation device for electrically stimulating the new contractile tissue in and/or near the damaged or diseased or myocardial tissue.
- 10 2. The implantable system of claim 1 wherein the cell repopulation source comprises undifferentiated contractile cells.
3. The implantable system of claim 2 wherein the undifferentiated contractile cells comprise skeletal muscle satellite cells.
- 15 4. The implantable system of claim 2 wherein the undifferentiated contractile cells comprise autologous cells.
5. The implantable system of claim 1 wherein the cell repopulation source comprises genetic material.
- 20 6. The implantable system of claim 5 wherein the genetic material comprises a delivery vehicle comprising a nucleic acid molecule.
- 25 7. The implantable system of claim 6 wherein the nucleic acid molecule encodes a myogenic determination gene.
8. The implantable system of claim 6 wherein the delivery vehicle comprises a viral expression vector.

9. The implantable system of claim 6 wherein the delivery vehicle comprises liposomes.
10. The implantable system of claim 5 wherein the genetic material comprises plasmid DNA.
11. The implantable system of claim 1 wherein the cell repopulation source further comprises a polymeric matrix.
- 10 12. The implantable system of claim 1 wherein the cell repopulation source is associated with a carrier.
13. The implantable system of claim 12 wherein the cell repopulation source is coated on a carrier.
- 15 14. The implantable system of claim 1 wherein the electrical stimulation device comprises a muscle stimulator having two electrodes connected thereto.
- 15 15. The implantable system of claim 14 wherein the muscle stimulator is implantable and is in the form of a capsule having electrodes incorporated therein.
- 20 16. The implantable system of claim 15 wherein the muscle stimulator is a carrier for the cell repopulation source.
- 25 17. The implantable system of claim 1 wherein the electrical stimulation device provides burst stimulation.
18. The implantable system of claim 1 wherein the electrical stimulation device provides pulse stimulation.

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19. An implantable system comprising:

- (a) a cell repopulation source for a patient's myocardium; and
- (b) an electrical stimulation device for electrically stimulating the new contractile tissue in and/or near the infarct zone of the patient's myocardium, wherein the electrical stimulation device provides burst stimulation.

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20. A method of repairing the myocardium of a patient, the method comprising:

- (a) providing an implantable system comprising:
 - (i) a cell repopulation source comprising genetic material, undifferentiated contractile cells, or a combination thereof, capable of forming new contractile tissue in and/or near an infarct zone of a patient's myocardium; and
 - (ii) an electrical stimulation device for electrically stimulating the new contractile tissue in and/or near the infarct zone of the patient's myocardium;
- (b) implanting the cell repopulation source into and/or near the infarct zone of the myocardium of a patient;
- (c) allowing sufficient time for new contractile tissue to form from the cell repopulation source; and
- (d) electrically stimulating the new contractile tissue.

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21. The method of claim 20 wherein the electrical stimulation device comprises a muscle stimulator and electrodes; wherein the electrodes are implanted into and/or near the infarct zone of the myocardium.

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22. The method of claim 20 wherein the muscle stimulator is implantable and is in the form of a capsule having electrodes incorporated therein.

23. The method of claim 22 wherein the muscle stimulator is a carrier for the cell repopulation source.

24. The method of claim 23 wherein the muscle stimulator and cell repopulation source are delivered to the infarct zone through a catheter.

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25. The method of claim 20 wherein the undifferentiated contractile cells comprise autologous cells.